

Attorney Docket No. ESP:106e US
US Application 10/643,344
Filed August 19, 2003



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Applicants: **N. WEINBERG et al.**

U.S. Patent Application No. **10/643,344**

Filed: **August 19, 2003**

Examiner: **WILKINS III, H. D.**

Group Art Unit: **1742**

Confirmation No.: **3828**

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For: **APPARATUS FOR ELECTROLYSIS OF WATER**

BRIEF ON APPEAL UNDER 37 CFR §41.37

Mail Stop Appeal Briefs - Patents
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the Final Rejection dated August 2, 2006. Claims 42-48 have been allowed. The balance of the claims in this application, namely claims 28-30 and 33-41 stand finally rejected, and are the subject of this appeal.

A **Claims Appendix** follows Page 28 of this brief.

An **Evidence Appendix** begins at page 31 of this brief.

A **Related Proceedings Appendix** begins on Page 32 of this brief.

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REAL PARTY IN INTEREST

The real party in interest is LECTRO PRESS, INC., Assignee of the captioned application by an assignment recorded in the United States Patent and Trademark Office at Reel 7222, Frame 0975.

RELATED APPEALS AND INTERFERENCES

Upon information and belief, no appeals or interferences are known to Appellant, which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 28-30 and 33-48 are currently in this application.

Claims 42-48 have been allowed

Claims 28-30 and 33-41 stand as finally rejected.

Claims 28-30 and 33-41 are the subject of this Appeal.

STATUS OF AMENDMENTS

In response to the FINAL Office Action of August 2, 2006, an Amendment and Request for Reconsideration was filed on November 2, 2006. An Advisory Action dated November 14, 2006, permitted entry of the amended claims, but **maintains all grounds of rejection**

It should be noted: the statement of the rejection in the FINAL Office Action of August 2, 2006, at page 3 rejects only claim 28 under 35 U.S.C. 103(a). However, the Advisory Action of November 14, 2006, clarified the Final Office Action by indicating: "The statement of the rejection grounds should read "**Claims 28-30 and 33-41 are rejected.....**"

SUMMARY OF CLAIMED SUBJECT MATTER

GENERAL SUMMARY

The present invention relates to an apparatus for the electrolysis of water comprising in combination **two (2) principal devices**, namely an electrochemical cell, as one device, for electrolysis of water for generating hydrogen gas at the cathode and oxygen at the anode of the cell, plus some heat. The electrochemical cell comprises an hydrogen storage cathode, an electrically conductive anode and a compartment for holding an ionically conducting aqueous electrolyte.

The second device of the claimed apparatus is a **pulsed power supply** comprising means for generating **repeating sequences of at least two voltage regimes** in powering the electrochemical cell. Generally, the **first cell voltage regime** is of low **amplitude relative to the second cell voltage regime, but of a "longer" duration**. The first cell voltage regime is usually applied as a constant and uniform voltage.

The function of the **first voltage regime** is to enhance or increase absorption/filling or transient packing of the cathode structure with hydrogen. The first cell voltage regime is usually applied as a constant and uniform voltage wherein hydrogen ions are reduced at the cathode and absorbed either as monoatomic hydrogen molecules or as diatomic hydrogen molecules. Thus, the hydrogen may be ordinary molecular hydrogen, but may also be isotopic hydrogen, such as deuterium or tritium.

The **second cell voltage regime** is then applied to the electrochemical cell, after the first cell voltage regime, as a pulsed voltage, as opposed to the uniform or constant voltage applied in the filling step (above) wherein the hydrogen filled cathode receives at least one higher voltage pulse of shorter duration relative to the first cell voltage regime.

The **second voltage regime** is also generated by the pulsed power supply and consists of at least one voltage pulse that is at least two times the voltage of the first cell voltage regime for a "**total duration**" of no greater than 0.10 seconds. Generally, it is the function of the **second cell voltage regime** to effectuate a change in the potential at the cathode of the electrochemical cell and bring about a rapid **compaction or compression of the hydrogen** imbibed by the cathode during the first cell voltage regime.

“Total duration”, as mentioned above, for purposes of this invention is defined at page 3 of the application to include all the time elements of a particular voltage pulse, including rise time, time at or near the maximum voltage and fall time. This is best illustrated by Figs. 1-2 of the drawings.

Fig. 1 of the drawings illustrates a representative applied cathode regime in the electrolysis of water according to the claimed invention. Starting with step (a) the cathode lattice is filled with hydrogen. This is performed by applying a relatively low negative potential ranging from -0.10 to -3.0 volts, and a cathode current density of 1mA/cm². The duration of this initial filling stage may run for a period ranging from seconds to days.

Step (b) of Fig. 1 illustrates an optional aspect of the invention wherein the cathode potential may from time-to-time be changed to a low positive value for purposes of cleaning the cathode of contaminants and produce a bare, clean electrode surface for more efficient operation and reduced power consumption. Step (b) may run for an interval ranging from milliseconds to minutes.

Step (c) of Fig. 1 represents an optimal resting period to reequilibrate the cathode for a period from seconds to minutes. This is then followed by a fourth perturbation, step (d), where the potential of the cathode is stepped to the negative side for a duration of seconds to days for further filling of the electrode with hydrogen.

In step (e) of Fig. 1, the second cell voltage regime in the form of relatively higher pulsed voltage, previously discussed, is imposed on the cell for a very short duration. For a period ranging from about 0.5 nanoseconds to 0.10 seconds, the high voltage pulse 4 is applied. **This pulse leads to an increase in cell voltage from about 2 to about 2000 times the voltage of the cathode filling voltage, i.e., the first cell voltage regime.** Thus, the high cathode potential will be from about -0.50 volts to approximately -4.0 volts. The maximum applied cathode potential of the second cell voltage regime is measured from the base or plateau 2 (Fig. 1) of the first cell voltage regime to a very steep peak 3, which is the rise time, the latter being measured by standard means, such as by an oscilloscope.

Fig. 2 illustrates a further representative applied cathode potential regime useful in the electrolysis of water according to Appellants' invention wherein a short duration high potential pulse 4 is dovetailed onto a low voltage alternating current regime 5. Wave forms can take a sinusoidal, triangular or square wave configuration which may also include combinations of these, as well as asymmetric wave forms.

Fig. 3 illustrates in block form the elements of the pulse drive system 10 of the present invention. System 10 includes clock oscillator 11 which provides a train of timing pulses to binary counter 12. Counter 12 counts the pulses, and decoder 13 reads or decodes the counted pulses and controls the timing sequence of current generator 14 (which provides the oscillating pulsed potentials to the anode and cathode of the electrochemical cell).

Fig. 4 is a detailed schematic circuit diagram of pulse drive system 10 (Fig. 3). This diagram adds to the enablement of the application because it provides a representative system for generation of the pulsed power supply for practicing the claimed invention. System 10 includes four appropriate power supplies, VS1, VS2, VS3, VS4, three of the 12 volt direct current (VDC) and one of 1000 volts direct current.

Fig. 5 is a view of the electrochemical cell and pulsed power supply employed in the electrolysis of water in generating oxygen, hydrogen and heat in accordance with the best mode working example on page 20 of the specification.

In sum, a principal feature of the claimed invention is a **pulsed power supply** device adapted to impose rapidly repeating sequences of at least two voltage regimes, wherein the first at a relatively low voltage of long duration enhances filling of the cathode with hydrogen or isotopic hydrogen, followed by a very rapid, short pulsed "spiking" voltage is applied to the cell in electrolyzing the imbibed electrolyte. Figs. 1 and 2 of the drawings best illustrate the foregoing voltage regimes.

Other features of the claimed invention provide for the pulsed power supply as **operatively arranged** so the second cell voltage regime is **dovetailed** (claim 30 and 34), or **superimposed** (claims 33 and 35) onto the first cell voltage regime. Also, the claimed invention provides for a sequence of voltage regimes where the pulsed power supply is a positive voltage for cleaning the anode (claim 36) or for cleaning the cathode (claim 37);

or where the pulsed power supply is **operatively arranged** to re-equilibrate the cathode in a region of zero potential (claims 38 and 39); or where the pulsed power supply is **operatively arranged** to apply a negative potential for further cathodic absorption of hydrogen (claims 40-41).

DETAILED EXPLANATION OF CLAIMED INVENTION

Independent Claim 28

Claim 28 provides for an apparatus for electrolyzing water for the production of hydrogen, oxygen and heat. Specific support *ipsissimis verbis* for the entire claim is found in a number of locations, but particularly at page 4 of the “**Preliminary Amendment**” filed with the original application papers on August 19, 2003.

In addition, support for claim 28 may be found in the specification at page 2, lines 24-36 and bridging over to page 3, lines 1-6.

Fig. 5 of the drawings also illustrates the electrochemical cell 50 and electronic pulsing device 32. The electrochemical cell includes anode 30, cathode 26 and electrolyte compartment 35.

The pulsed power supply recited in claim 28, part (ii) is defined by **means plus a statement of function**, i.e., “...means for generating a repeating sequence of voltages across said anode and said cathode...” The **means for generating** the repeating sequence of voltages is best represented by the **pulsed power supply** illustrated in the schematic diagram of Fig. 4 of the drawings, which is also described in detail in the written description of the invention at page 15, beginning at line 23 through page 17, line 28 of the specification.

Dependent claim 29 (SEPERATELY PATENTABLE)

Dependent claim 29 finds express support word-for-word in the “**Preliminary Amendment**” filed with the original application papers on August 19, 2003. It appears at the bottom of page 4 and the top of page 5 of the “**Preliminary Amendment**”.

Specific support for dependent claim 29 is also recited at page 4 of the specification, lines 17-32 as originally filed.

Dependent claims 30 and 34 (SEPERATELY PATENTABLE)

Dependent claims 30 ands 34 find express support word-for-word in the “Preliminary Amendment” filed with the original application papers on August 19, 2003. It appears on page 5 of the “Preliminary Amendment”.

Specific support for dependent claims 30 and 34 is also recited at page 4, lines 2-6 of the specification.

Fig. 2 of the drawings also supports the subject matter of claims 30 and 34, illustrating the electrolysis of water wherein a short duration, high potential pulse 4 is **dovetailed** onto a low voltage AC current regime 5. This is also discussed at page 13, lines 31-35 of the specification.

Dependent claims 33 and 35 (SEPERATELY PATENTABLE)

Dependent claims 33 and 35 find express support word-for-word in the “Preliminary Amendment” filed with the original application papers on August 19, 2003. It appears on page 5 of the “Preliminary Amendment”.

The concept of superimposing voltages wherein the second cell voltage regime is superimposed onto the first cell voltage regime is also described on page 18, lines 6-16 of the specification, and at page 22, lines 3-11.

Dependent claims 36 and 37 (SEPERATELY PATENTABLE)

Dependent claims 36-37 find express support, word-for-word in the “Preliminary Amendment” filed with the original application papers on August 19, 2003. It appears at page 5 of the “Preliminary Amendment”.

The subject concept of claims 36 and 37 also find specific support in the specification at page 4, lines 7-16; page 13, lines 1-12 and at page 20, lines 4-7.

Dependent claims 38 and 39 (SEPERATELY PATENTABLE)

Dependent claims 38-39 find express support, word-for-word in the "Preliminary Amendment" filed with the original application papers on August 19, 2003. It appears at page 6 of the "Preliminary Amendment".

Page 13, lines 7-12 of the specification also discusses the subject-concept of claims 38-39.

Dependent claims 40 and 41 (SEPERATELY PATENTABLE)

Dependent claims 40-41 find express support, word-for-word in the "Preliminary Amendment" filed with the original application papers on August 19, 2003. It appears at page 6 of the "Preliminary Amendment".

Page 4, lines 7-16 and page 12, lines 20-35 and page 13 also support the concept of claims 40-41. In addition Fig. 1 of the drawings also discussed on page 12, beginning at line 20 and bridging over to page 13, to line 30 of the specification also provides detailed support for claims 40-41.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

- (a) Whether claims 28-30 and 33-41 rejected in the Final Office Action of August 2, 2006, are non-obvious under 35 U.S.C. 103(a) to a person having ordinary skill in the art at the time the invention was made, and therefore, patentable over International Application WO 90/10935 (Pons et al) in view of US Pat. 3,944,473 (Spaepen et al).
- (b) Whether the rejection of dependent claims 29-30 and 33-41 under 35 U.S.C. 103(a) can be made out on the ground that the **prior art devices can perform all the functions of the claimed apparatus** when the rejection implicitly acknowledges neither of the **references relied on anticipates** the claimed apparatus under 35 U.S.C. 102.

ARGUMENT

(a) Whether claims 28-30 and 33-41 rejected in the Final Office Action of August 2, 2006, are non-obvious under 35 U.S.C. 103(a) to a person having ordinary skill in the art at the time the invention was made, and therefore, patentable over International Application WO 90/10935 (Pons et al) in view of US Pat. 3,944,473 (Spaepen et al)?

Summary of the Rejection

Claims 28-30 and 33-41 stand rejected under 35 U.S.C. 103(a) as unpatentable over Pons et al (WO 90/10935) in view of Spaepen et al (US 3,944,473).

Discussion of References Cited in support of the Final Office Action

WO 90/10935 Pons et al:

Pons et al disclose an electrochemical cell with an anode and a porous cathode. The Pons et al process relates to the production of heat while producing hydrogen at the cathode and oxygen at the anode. The method of Pons et al initially takes up hydrogen by "charging" means which operates to first fill the electrode with isotopic hydrogen in the metal lattice by applying a single voltage regime. This also results in concentrating the isotopic hydrogen in the metal lattice of the electrode. Ultimately, the concentrated isotopic hydrogen undergoes electrolytic reduction to form isotopic hydrogen atoms, tritium, and so on.

Importantly, the methods of Pons et al employ a single voltage regime for filling and concentrating isotopic hydrogen in a cathode and for the generation of hydrogen, oxygen and heat.

Accordingly, Pons et al do not teach as to anticipate, or suggest as to render obvious a **power supply** suitable for manipulation of an electrochemical cell, wherein a repeating sequence or plurality of different voltage regimes are applied (or superimposed) in the operation of their cell, like those recited in the claims on appeal.

US 3,944,473 (Spaepen et al)

Spaepen et al pertains to a method for influencing an electrocatalytic reaction proceeding at an electrode, according to which a pulse is **superimposed** on the electrode potential. According to Col. 1, lines 16-19, "**The duration of the pulses used is rather long and lies in the range of minutes to hours.**"

More specifically, Spaepen et al disclose in Col. 1, lines 10-19 that:

"It is already known to obviate partly some of the ageing [sic] phenomena which occur in existing electrocatalysts by bringing temporally the catalyst-forming electrode to another potential. This does not provide better electrocatalytic action but only partially restores the original catalytic action.

The duration of the pulses used is rather long and lies in the range of seconds to minutes, while the working time between pulses lies in the range of minutes to hours." (emphasis added)

According to Spaepen et al, their objectives are to conduct oxidation reactions electrochemically at the anode, **but not with water, as expressly recited in the claims on appeal.** Spaepen et al methods relate to the **oxidation of methanol on a platinum electrode, and the oxidation of hydrogen, hydrazine or ammonia.**

Arguments traversing the rejection of claims 28-30 and 33-41 under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al:

Page 3 of the **Final Office Action** of 8/2/06, expressly provides:

"Pons et al teach (see pages 19-29) an apparatus for electrolyzing water for the production of hydrogen, oxygen and heat that included an electrochemical cell having a palladium cathode (i.e.-isotopic hydrogen storage cathode), an electrically conductive anode and a compartment for holding an ionically conducting electrolyte comprising water and a pulsed power supply for the electrochemical cell comprising a

means for generating a repeating sequence of voltages across the anode and cathode.

The difference between the claimed apparatus and the apparatus of Pons et al is that the pulsed power supply of Pons et al generates only a single voltage regime consisting of a voltage sufficient to enhance cathodic absorption of hydrogen. Thus, Pons et al fail to teach a second voltage regime consisting of at least one voltage pulse which is at least two times the voltage of the first cell voltage regime in magnitude with a duration not greater than 0.10 seconds." (Emphasis added)

It is noteworthy, the Final Office Action expressly acknowledges that Pons et al are silent with respect to the disclosure of a second voltage regime, and furthermore, fail to teach (or suggest) a second voltage regime according to finally rejected claim 28, part (ii)

Appellants maintain that Pons et al. disclose a conventional electrochemical cell with an anode and a porous cathode, the latter having an absorptive lattice structure. The Pons et al. process relates to the generation of heat while producing hydrogen and oxygen. Significantly, Pons et al. do not manipulate the cell by applying a repeating sequence of voltage regimes by employing a power supply device suitable for generation such a voltage regime, nor do they teach or suggest a regime specifically for enhancing absorption of hydrogen at the cathode, followed by a much higher voltage of shorter duration.

The Final Office Action at page 3 also acknowledges that *Pons et al.* lack a teaching of a second voltage regime consisting of at least one voltage pulse which is at least two times the voltage of the first cell voltage regime in magnitude with a duration not greater than 0.10 seconds.

It is unclear from reading Spaepen et al., who do not teach either the use of **hydrogen storage cathodes or the electrolysis of water for making hydrogen at the cathode and oxygen at the anode**, what the rationale was for combining with the teachings of Pons et al. The objective of Spaepen et al. is to conduct oxidation reactions electrochemically at the anode, but not with water. More specifically, Spaepen et al. teach applying a potential pulse train for influencing an electrocatalytic reaction

proceeding at the electrode, where this reaction is the oxidation of methanol on platinum or the oxidation of hydrogen, hydrazine, or ammonia on an alloy. (Spaepen et al., Col. 1, lines 42-57). Thus, reactions of Spaepen et al. include the oxidation of methanol, hydrogen and ammonia using superimposed pulsed voltages which reactions do not lead to the production of oxygen at the anode or hydrogen at the cathode. **Importantly, Spaepen et al. is not at all concerned with the electrolysis of water, as in the case of Pons et al.**

Spaepen et al. also teach that it was already known to obviate the aging phenomenon which occurs in electrocatalysts by bringing the electrode to another potential. (Spaepen et al., Col. 1, lines 10-15). Appellants submit that Spaepen et al. do not teach that the inventive pulse regime obviates aging phenomena, only that it was known in the art to obviate these phenomena by bringing the electrode to another potential. (Spaepen et al., Col. 1, lines 10-15).

Additionally, it is further pointed out the record shows during *ex parte* prosecution no clear reason or suggestion has been identified why one of ordinary skill in the art of electrolyzing water would have included the pulsed regime of Spaepen et al. in the method of Pons et al., whether used to obviate aging phenomena or to influence the specified oxidation reactions at the electrode.

Thus, the FINAL Office Action has failed to identify why Pons et al. would have desired obviation of aging phenomenon.

The Examiner's Advisory Action dated 11/14/06 at page 2 urges:

“...the motivation for combination between Pons et al and Spaepen et al involves the teaching of Spaepen et al (See col. 4, lines 23-35) that the additional voltage pulses were utilized for choosing a preferential reaction when more than one reaction was capable of occurring at the electrode and that Pons et al specifically teach two competing reactions at the cathode.” (Emphasis added)

Appellants courteously disagree.

Pons et al are not teaching two competing reactions at the cathode as alleged by the Advisory Action. Competing (electrochemical) reactions referenced by the Examiner

relative to Spaepen et al are not occurring at the cathode of Pons et al. An electrochemical reduction reaction is occurring at the cathode of Pons et al, as it normally does in the electrolysis of water in forming hydrogen (and oxygen at the anode). And, there are no competing (chemical) reactions occurring, as the Advisory Action urges.

The advisory Action appears to be confusing chemical reactions referenced by Spaepen et al with the modified physical conditions utilized by Pons et al in their electrolysis of water. The invention of Pons et al relates to methods for modifying the physical conditions of the electrochemical cell to induce saturating the lattice structure of the cell cathode to achieve concentration of isotopic hydrogen for enhancing the generation of heat energy, in addition to the production of hydrogen. To achieve this result, Pons et al utilize a generator source 20 in the system connected conventionally to the electrodes for producing the desired electrolytic decomposition. The power source may be a steady DC power supply or alternatively an intermittent or pulsed DC charge or current source. However, the power supply generates but a single voltage regime, unlike the claims on appeal.

But, above all, contrary to the **Advisory Action of 11/14/06**, Pons et al fail to expressly teach or suggest competing reactions occurring at the cathode, as alleged in the Advisory Office Action. Coupled with the fact that the method of Spaepen et al is suggested only in connection with the oxidation of methanol on a platinum electrode, oxidation of hydrogen, hydrazine or ammonia on an alloy electrode, **there is simply no motivation for combining Spaepen et al with Pons et al.**

Hence, it appears that Spaepen et al. was combined with Pons et al. based solely on hindsight in view of Appellants claiming a second voltage regime. "When relying on numerous references or a modification of the prior art, it is incumbent on the examiner to identify some suggestion to combine references or make the modification." *In re Mayne*, 104 F.3d 1339, 1342, 41 U.S.P.Q.2d 1451, 1454 (Fed. Cir. 1997). In fact, it is well settled that before a conclusion of obviousness may be made based on a combination of references, there must have been a reason, suggestion, or motivation to lead the inventors to combine those references. *See Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 U.S.P.Q.2d 1626, 1629 (Fed. Cir. 1996). Unless there is some

suggestion, teaching or rational in the prior art itself, it is impermissible within the framework of 35 U.S.C. § 103 to combine references based on hindsight from a prior reading of Appellants' own disclosure. Indeed, "to imbue one of ordinary skill in the art with knowledge of the invention...when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *In Re Lee*, 61 U.S.P.Q. 2d 1430 (Fed. Cir. 2002); *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1983). Appellants courteously submit that there is simply no perceived basis for combining the disclosures of Pons et al. with those of Spaepen et al..

The objectives of Pons et al. and Spaepen et al. do not converge.

Appellants courteously submit: the Board of Patent Appeals and Interferences has previously considered the combination of Pons et al. and Spaepen et al., during the prosecution of the parent application, *i.e.*, United States Patent Application No. 08/334,952 which issued as United States Patent No. 6,638,413 on October 28, 2003. Although the claims on appeal in the captioned application are drawn to an apparatus, and the claims of the parent application *supra*, are drawn to methods, the motivation, and more correctly, the lack thereof, to combine Pons et al. and Spaepen et al., as urged by the Examiner, is fundamentally the same and has been previously struck down by the Board in its decision of 1/31/03 (of record). (See **Evidence appendix following page 30 of this brief for a copy of the Decision of the Board**).

Appellants included a copy of the Board decision in connection with Appeal No. 1999-0928, as an appendix in its reply to the Final Office Action of 8/2/06, of the subject application. Appellants respectfully point out; pages 13-15 of the Board decision set forth further reasons why Pons et al. and Spaepen et al. cannot be properly combined in accordance with the Examiner's assertions in the instant application.

Once again, even assuming arguendo that Pons et al. and Spaepen et al. could be combined, which they cannot, but even if they could Appellants' claimed invention would still not be arrived at. In this regard, Spaepen et al. disclose at Column 1, lines 10-19:

"It is already known to obviate partly some of the ageing [sic] phenomena which occur in existing electro-catalysts by bringing temporally the catalyst-forming electrode to another potential. This does not provide better electrocatalytic action but only partially restores the original catalytic action.

The duration of the pulses used is rather long and lies in the range of seconds to minutes, while the working time between pulses lies in the range of minutes to hours." (emphasis added)

According to Appellants' Claim 28, the second cell voltage regime consists of at least one pulse with a voltage which is at least two times greater than the first cell voltage regime, and runs for a period not exceeding 0.1 seconds. Thus, Appellants' claimed pulses consist of ultra short bursts of high spiking voltage compared to those of Spaepen et al., who teach overcoming the aging phenomenon with lengthy pulses running for seconds to minutes. Accordingly, while Spaepen et al. teach a second voltage regime, the duration of the pulses according to Spaepen et al. for the utility of overcoming the aging phenomenon is **many times greater than the pulse duration of Appellants' claimed invention**. Once again, Appellants' claimed pulses may not exceed 0.1 seconds, and is usually measured in nanoseconds, i.e., one billionth of a second. (See for example Appellants' Claim 29).

Accordingly, even if Spaepen et al. teach a second voltage regime used in electrocatalytic reactions as urged in the Final Office Action, the claims on appeal would still not be arrived at in view of the fact that the pulsed voltages suggested by this reference far exceed the maximum duration permitted by Appellants' claims.

Second Issue of this Appeal

(b) Whether the rejection of dependent claims 29-30 and 33-41 under 35 U.S.C. 103(a) can be made out (*prima facie*) on the ground that the **prior art devices (Pons et al and**

Spaepen et al) can perform all the functions of the claimed apparatus when the rejection under 35 U.S.C. 103(a) implicitly acknowledges neither of the references relied on anticipates the claimed apparatus under 35 U.S.C. 102.

Arguments traversing that aspect of the rejection relative to dependent claims 29-30 and 33-41 under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al, wherein it is alleged at page 5 of the Final Office Action: the claims are related to the manner of operation of the claimed apparatus, and therefore, have not been given patentable weight since the apparatus of Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

This aspect of the Final rejection is courteously traversed because neither Pons et al, nor Spaepen et al alone teach (35 U.S.C. 102) or suggest (35 U.S.C. 103) Appellants' claimed apparatus.

As best understood, it is the position of the examiner as set-forth in the first full paragraph on page 5 of the Final Office Action, that because the apparatus recited in claims 29-30 and 33-41 is allegedly unpatentable for reasons of obviousness (35 U.S.C. 103) over Pons et al in view of Spaepen et al, Appellants further characterization of the pulses provided by the power supply apparatus do not have to be considered because the apparatus arrived at by combining Pons et al and Spaepen et al will inherently provide the same voltage regimes recited by rejected claims 29-30 and 33-41.

At the outset, Appellants wish to courteously point out the important fact that the limitations recited in independent claim 28 and dependent claims 29-30 and 33-41 with respect to the voltage regimes are not related to the manner of operation of the power supply apparatus as alleged in the Final Office Action. Instead, the recited voltage regimes are characteristics of the power supply apparatus.

More specifically, the pulsed power supply portion of Appellants' claims (independent claim 28, etc.) are characterized by means, plus a statement of function (35 U.S.C. 112, sixth para.), i.e., means for generating a repeating sequence of voltages starting with a first cell voltage regime sufficient to enhance cathodic absorption of

hydrogen, followed by second cell voltage regime which is at least two times the voltage of the first cell voltage regime in magnitude with a duration no greater than 0.10 seconds. In support of the means plus statement of function, Appellants have disclosed a detailed schematic diagram of such device in Fig. 4 of the drawings.

Appellants submit, the examiner's contention that dependent claims 29-30 and 33-41 on appeal are unpatentable under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al cannot stand because the conclusion the applied references **taken together** are capable of (inherently) performing Appellant's pulsed voltages can only be made out when it has been demonstrated the claims **lack novelty and are unpatentable under 35 U.S.C. 102**. It is well established that the doctrine of "inherency" is prefaced on each and every limitation of the claimed invention being disclosed in a **single prior art publication**, and not with a combination of publications, i.e., Pons et al in view of Spaepen et al, as in the instant rejection wherein it is urged the combined teachings of Pons et al and Spaepen et al are (inherently) capable of operating in the claimed fashion.

It is also noteworthy, in this aspect of the rejection the examiner cites as authority at page 5 of the Final Office Action the MPEP Section 2114.

According to the MPEP Section 2114 (Page 2100-53), the manner of operating a device may **not** differentiate an apparatus claim from the prior art. More specifically,

"A claim containing a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987) (The preamble of claim 1 recited that the apparatus was "for mixing flowing developer material" and the body of the claim recited "means for mixing ..., said mixing means being stationary and completely submerged in the developer material". The claim was rejected over a reference which taught all the structural limitations of the claim for the intended use of mixing flowing developer. However, the mixer was only partially submerged in the developer material. The Board held that the amount of submersion is immaterial to the structure of the mixer and thus the claim was properly rejected.). " (Emphasis added)

In Masham *supra*., the rejection of the claims was under 35 U.S.C. 102(b) as anticipated by Williams (US 4,075,977).

Here again, as pointed out above in connection with the rejection of claims 28-30 and 33-41, under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al, neither of these references taken alone, (or together in combination), teach **all** the structural features of the claimed pulsed power supply. But, even if they did, the rejection for reasons of obviousness over Pons et al in view of Spaepen et al would not satisfy the requirement that the combined teachings are sufficient to conclude that the prior art is (**inherently**) capable of operating in the claimed fashion, as urged at page 5 of the Final Office Action, and as such eliminates the need for the examiner to cite published prior art demonstrating how the art renders the claims unpatentable. Simply put, the examiner has not shown how Pons et al in view of Spaepen et al meet the criteria of dependent claims 29-30 and 33-41. Instead, the reliance on the references collectively disclosing the inherent ability of generating a sequence of pulsed voltages in the face of an **obviousness rejection cannot be sustained**, for reasons *supra*.

For example, **claim 28** from which claims 29-30 and 33-41 depend, provides means for generating a repeating sequence of voltages across the anode and cathode where each sequence includes a first cell voltage regime consisting of a voltage sufficient to enhance cathodic absorption of hydrogen and a second voltage regime consisting of at least one voltage pulse which is at least two times the voltage of the first cell voltage regime in magnitude with a duration no greater than 0.10 seconds.

Significantly, page 3 of the Final Office Action of 8/2/06 expressly acknowledges Pons et al generate only a single cell voltage regime, and also fail to teach a second cell voltage regime consisting of at least one voltage pulse which is at least two times the voltage of the first cell voltage regime in magnitude with a duration not greater than 0.10 seconds. Hence, by the examiner's own admission Pons et al alone do not anticipate, under 35 U.S.C. 102, the subject matter of the finally rejected claims.

As in the case of Pons et al, Spaepen et al, taken alone, also do not anticipate under 35 U.S.C. 102, the subject matter of claims 29-30 and 33-41, on appeal.

For example, Fig. 2 of Spaepen et al illustrates a sequence of two repeating negative voltages of the same amplitude and the same duration, rather than a sequence of at least two voltage regimes, wherein the first voltage regime generated by the pulsed

power supply according to dependent claim 29, for example, ranges from 1 to 10 volts and a second voltage regime ranging from 2 to 1000 times the voltage of the first cell voltage regime for a duration ranging from 0.5 nanoseconds to about 0.10 seconds.

Fig. 3 of Spaepen et al illustrates two identical repeating positive voltages, rather than a sequence of repeating voltage regimes of differing magnitudes and durations according dependent claims 29 and 33-41.

Fig. 4 of Spaepen et al illustrates a repeating sequence of voltages, however, the magnitude of the first positive voltage is **significantly greater** than the second negative voltage, whereas Appellants claim voltage regimes wherein the amplitude of the second cell voltage is greater than the first cell voltage. Thus, Spaepen et al teach a first voltage followed by a second voltage wherein the second voltage is approximately one-half to one-third of the first voltage, *i.e.*, the second voltage is smaller than the first voltage. Contrarily, Appellants recite a first voltage followed by a second voltage wherein the second voltage is at least two times greater than the first voltage, *i.e.*, the second voltage is greater than the first voltage.

According to Appellants' Claim 28, the second cell voltage regime consists of at least one pulse with a voltage which is at least two times greater than the first cell voltage regime, and runs for a period not exceeding 0.1 seconds. Thus, Appellants' claimed pulses consist of very short bursts of spiked high voltage compared to those of *Spaepen et al.*, who teach overcoming the aging phenomenon with lengthy pulses running for seconds to minutes. Accordingly, while Spaepen et al. teach a second voltage regime, the **duration** of the pulses according to Spaepen et al. for the utility of overcoming the aging phenomenon is many times greater than the pulse duration of Appellants' claimed invention. Once again, Appellants' claimed pulses may not exceed 0.1 seconds, and is usually measured in nanoseconds, *i.e.*, one billionth of a second. (See for example Appellants' Claim 29).

Accordingly, even if Spaepen et al. teach a second voltage regime used in electrocatalytic reactions as urged in the Office Action, the claims under examination would still not be arrived at in view of the fact that the pulsed voltages

suggested by this reference far exceed the maximum duration permitted by Appellants' claims.

Finally, Appellants wish to highlight, once again, for the Board of Patent Appeals and Interferences the fact that the Board had previously considered the combination of Pons et al. and Spaepen et al., during the prosecution of the parent case, *i.e.*, United States Patent Application No. 08/334,952, which issued as United States Patent No. 6,638,413 on October 28, 2003, in a rejection of the claims over Pons et al taken in view of Spaepen et al. (**see the Board decision in the EVIDENCE APPENDIX beginning after page 30 of this brief**) Although the claims of this appeal are drawn to an apparatus and the parent application was drawn to a method, the motivation to combine Pons et al. and Spaepen et al., as described by the Examiner is nevertheless still lacking, and was previously struck down by the Board.

Accordingly, reversal of the rejection of claims 28-30 and 33-41 under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al is courteously solicited.

SEPARATELY PATENTABLE CLAIMS

However, even if independent claim 28 is found to be unpatentable for reasons of obviousness over Pons et al in view of Spaepen et al, Appellants maintain dependent claims 29-30 and 33-41 would still be separately patentable over Pons et al in view of Spaepen et al for the following reasons.

Dependent Claim 29

Pons et al disclose a device for imposing only a single cell voltage regime to an electrochemical cell in the electrolysis of water, to form hydrogen, oxygen and heat, also fully acknowledge by the Final Office Action of 8/2/06.

Unlike the electrolysis of water of Pons et al, Spaepen et al disclose a power supply for applying superimposed voltages in organic electrosynthesis reactions, e.g., oxidation of methanol on platinum, oxidation of a material by the hydrogen, hydrazine and ammonia on an alloy.

According to Spaepen et al, Col. 1, lines 16-19, a pulse regime is employed consisting of a “duration of pulses used is rather long and lies in the range of seconds to minutes, while the working time between pulses lies in the range of minutes to hours.”

Appellants’ claim 29 provides for a first cell voltage regime of about 1 to about 10 volts and a second cell voltage regime ranging from 2 to 1000 times the voltage of the first cell voltage regime with a duration from about 0.5 nanoseconds (billionth of a second) to a 0.10 of a second.

In other words, Appellants’ Claim 29 includes a voltage regime that is very high (up to 1000 times the voltage of the first voltage regime), but of an ultra short duration, (as little as a 0.5 billionth of a second).

In sum, the organic electrosynthesis reactions of Spaepen et al are distinct from the electrolysis of water of Pons et al, and the voltage regimes of Spaepen et al, as well as Pons et al are substantially different from those of claim 29, i.e., Appellants voltage regime consisting of a very high amplitude and of extremely short duration pulse (claim 29). Hence, Appellants’ claim 29 is distinct and mutually exclusive from that of Spaepen et al. It is important to recognize Appellants’ claimed invention provides for operating in the microsecond range with voltages that are kilovolts, and not millivolts like Spaepen et al, a difference by a factor of thousands.

Appellants also highlight pages 13-15 of the Board Decision of January 31, 2003 (attached) as further evidence in support of the non-obviousness of claim 29 over Pons et al in view of Spaepen et al. The Board in the parent case (SN 08/334,952) of the captioned application reversed the examiner’s rejection of the claims on appeal for reasons of obviousness also over Pons et al in view of Spaepen et al.

The Board’s attention is also courteously directed to Appellants’ remarks above appearing on pages 17-18 of this appeal brief, wherein the Examiner incorrectly urges the limitations of claim 29 should be given no weight because Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

In sum, the examiner has failed to show how the combination of Pons et al in view of Spaepen et al make out a *prima facie* case of obviousness relative to claim 29, but instead has erroneously chosen to discount the limitations of dependent claim 29 by asserting that the combined teachings of the references are capable of operating in the claimed fashion. Such a conclusion may only be properly considered in a rejection based on a **lack of novelty under 35 U.S.C. 102**, and not under 35 U.S.C. 103.

Accordingly, claim 29 should be viewed as drawn to separately patentable subject matter.

Dependent Claims 30 and 34:

Claims 30 and 34 are also **separately patentable** even if the rejections of independent claim 28 and dependent claim 29 are sustained. Claims 30 and 34 include all the limitations of claims 28 and 29 from which they depend, but further limit the claims by providing for the pulsed power supply operatively arranged to **dovetail** the second cell voltage regime onto the first cell voltage regime.

In response thereto, Appellants maintain neither Pons et al nor Spaepen et al teach or suggest a train of **dovetailing** voltage regimes. Consequently, the combination of Pons et al and Spaepen et al fail to make out the required *prima facie* case of obviousness under 35 U.S.C. 103(a).

The attention of the Board is, once again, also courteously directed to Appellants' remarks above appearing on pages 17-18 of this appeal brief, wherein the Examiner incorrectly urges the limitations of claims 30 and 34 should be given no weight because Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

Here again, the examiner has failed to show how the combination of Pons et al in view of Spaepen et al make out a *prima facie* case of obviousness relative to claims 30 and 34, but instead has erroneously chosen to discount the limitations of dependent claims 30 and 34 by asserting that the combined teachings of the references are capable of operating in the claimed fashion. However, such a conclusion may only be correctly

considered in a rejection based on a lack of novelty under 35 U.S.C. 102, and not under 35 U.S.C. 103.

Accordingly, claims 30 and 34 should be viewed as drawn to separately patentable subject matter.

Dependent Claims 33 and 35:

Appellants maintain claims 33 and 35 are also separately patentable even if the rejections of independent claim 28 and dependent claim 29 are sustained. Claims 33 and 35 include all the limitations of claims 28 and 29 from which they depend, but further limit the claims by providing for the pulsed power supply operatively arranged to superimpose the second cell voltage regime onto the first cell voltage regime.

In response thereto, Appellants maintain Pons et al and Spaepen et al, in combination, fail to teach or suggest the voltage regimes of claims 28 and 29, including a pulsed power supply operatively arranged to superimpose the second cell voltage regime onto the first cell voltage regime in accordance with dependent claims 33 and 35.

Consequently, the combination of Pons et al and Spaepen et al fail to make out the required *prima facie* case of obviousness under 35 U.S.C. 103(a).

The attention of the Board is also courteously directed to Appellants' remarks above appearing on pages 17-18 of this appeal brief, wherein the Examiner incorrectly urges the limitations of claims 33 and 35 should be given no weight because Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

As previously pointed out, the examiner has failed to show how the combination of Pons et al in view of Spaepen et al make out a *prima facie* case of obviousness relative to claims 33 and 35, but instead has erroneously chosen to discount the limitations of dependent claims 33 and 35 by asserting that the combined teachings of the references are capable of operating in the claimed fashion. However, such a conclusion may only be correctly considered in a rejection prefaced on a lack of novelty under 35 U.S.C. 102, and not under 35 U.S.C. 103.

Accordingly, claims 33 and 35 should be viewed as drawn to separately patentable subject matter.

Independent Claims 36 and 37

Appellants maintain claims 36-37 are also separately patentable even if the rejection of independent claim 28 is sustained. Claims 36 and 37 include all the limitations of claim 28 from which they depend, but further limits the claims by providing for a pulsed power supply wherein each sequence of the power supply includes a positive voltage sufficient for cleaning the anode (claim 36) and the cathode (claim 37).

In response thereto, Appellants maintain Pons et al and Spaepen et al, in combination, fail to teach or suggest a pulsed power supply for cleaning the anode or the cathode, in accordance with dependent claims 36 and 37.

Consequently, the combination of Pons et al and Spaepen et al fail to make out the required *prima facie* case of obviousness under 35 U.S.C. 103(a).

The attention of the Board is also courteously directed to Appellants' remarks above appearing on pages 17-18 of this appeal brief, wherein the Examiner incorrectly urges the limitations of claims 36 and 37 should be given no weight because Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

As previously pointed out, the examiner has failed to show how the combination of Pons et al in view of Spaepen et al make out a *prima facie* case of obviousness relative to claims 36 and 37, but instead has erroneously chosen to discount the limitations of dependent claims 36 and 37 by asserting that the combined teachings of the references are capable of operating in the claimed fashion. However, such a conclusion may only be correctly considered in a rejection based on a lack of novelty under 35 U.S.C. 102, and not under 35 U.S.C. 103.

Accordingly, claims 36 and 37 should be viewed as drawn to separately patentable subject matter.

Dependent claims 38-39

Appellants maintain claims 38 and 39 are also separately patentable even if the rejections of independent claim 28 and dependent claim 29 are sustained. Claims 38 and 39 include all the limitations of claims 28 and 29, from which they depend, but further

limit claims 38 and 39 by providing for the pulsed power supply operatively arranged to re-equilibrate the cathode in a region of zero potential.

Appellants maintain Pons et al and Spaepen et al, in combination, fail to teach or suggest the voltage regimes of claims 28 and 29, including a pulsed power supply operatively arranged to re-equilibrate the cathode in a region of zero potential. The examiner has failed to identify where the cited references teach or suggest the apparatus of claims 38 and 39.

Consequently, the combination of Pons et al and Spaepen et al fail to make out the required *prima facie* case of obviousness under 35 U.S.C. 103(a).

The attention of the Board is also courteously directed to Appellants' remarks above appearing on pages 17-18 of this appeal brief, wherein the Examiner incorrectly urges the limitations of claims 38 and 39 should be given no weight because Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

As previously mentioned, the examiner has failed to show how the combination of Pons et al in view of Spaepen et al make out a *prima facie* case of obviousness relative to claims 38 and 39, but instead has erroneously chosen to discount the limitations of dependent claims 38 and 39 by asserting that the combined teachings of the references are capable of operating in the claimed fashion.

However, such a conclusion may only be correctly considered in a rejection prefaced on a lack of novelty under 35 U.S.C. 102, and not under 35 U.S.C. 103.

Accordingly, claims 38 and 39 should be viewed as drawn to separately patentable subject matter.

Dependent Claims 40 and 41

Appellants maintain claims 40 and 41 are also separately patentable even if the rejections of independent claim 28 and dependent claims 36 and 37 are sustained. Claims 40 and 41 include all the limitations of claims 28 and 36 or 37 from which they depend, but further limit the claims by providing for the pulsed power supply operatively arranged to apply a negative potential for further cathodic absorption of hydrogen.

Appellants maintain Pons et al and Spaepen et al, in combination, fail to teach or suggest a pulsed power supply according to claims 28 and 36 or 37, including a pulsed power supply operatively arranged to apply a negative potential for further cathodic absorption of hydrogen according to claims 40-41.

Consequently, the combination of Pons et al and Spaepen et al fail to make out the required *prima facie* case of obviousness under 35 U.S.C. 103(a).

The attention of the Board is also courteously directed to Appellants' remarks above appearing on pages 17-18 of this appeal brief, wherein the Examiner incorrectly urges the limitations of claims 40 and 41 should be given no weight because Pons et al in view of Spaepen et al would have been fully capable of operating in the claimed fashion.

As previously pointed out, the examiner has failed to show how the combination of Pons et al in view of Spaepen et al make out a *prima facie* case of obviousness relative to claims 40 and 41, but instead has erroneously chosen to discount the limitations of dependent claims 40 and 41 by asserting at page 5 of the Final Office Action: that the combine teachings of the references are capable of operating in the claimed fashion. However, such a conclusion may only be correctly considered in a rejection based on a lack of novelty under 35 U.S.C. 102, and not under 35 U.S.C. 103.

Accordingly, claims 40 and 41 should be viewed as drawn to separately patentable subject matter.

CONCLUDING REMARKS

The Final Office Action of 8/2/06, contains a single ground of rejection wherein claims 28-30 and 33-41 stand rejected under 35 U.S.C. 103(a) as unpatentable over Pons et al in view of Spaepen et al.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

- i) There must be some suggestion or motivation, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings;
- ii) There must be a reasonable expectation of success, and

- iii) The prior art reference or references when combined must teach or suggest all the claim limitations.

As pointed out above, Pons et al teach an electrochemical cell for the electrolysis of water for generating hydrogen at a cathode and oxygen at the anode and also some heat. Pons et al also disclose a power supply for the electrolysis cell that generates a **single pulse regime** for enhancing absorption of the isotopic hydrogen and electrolyzing the water. The examiner expressly acknowledges at page 3 of the Final Office Action that **Pons et al fail to teach a second voltage regime** in accordance with Appellants claims. There is no teaching or suggestion by Pons et al for manipulating voltages applied to their electrochemical cell **or superimposing cell voltages on one another**.

Spaepen et al teach a power supply apparatus to conduct oxidation reactions electrochemically at the anode, but not with aqueous solutions like Pons et al. Spaepen et al perform oxidation reactions, particularly the oxidation of methanol, hydrogen and ammonia by applying superimposed voltages.

The examiner urges in his Advisory Action of 11/14/06, the motivation for combining Pons et al and Spaepen et al can be found in col. 4, lines 23-35 of Spaepen et al, allegedly that additional pulsed voltages are utilized by Spaepen et al for choosing a preferential reaction when more than one reaction is capable of occurring at an electrode, and that Pons et al specifically teach two competing reactions at the cathode.

Contrary to the Advisory Action, Pons et al are performing an electrolysis reaction with an aqueous electrolyte (heavy water D₂O) or deuterated water to produce hydrogen (deuterium D₂) at the cathode and oxygen at the anode. Pons et al disclose no specific competing reactions occurring at the cathode, contrary to the examiner's advisory action of 11/14/06.

Besides, the methods of Spaepen et al provide no clear teaching which would motivate Pons et al to look to the methods of Spaepen et al and to superimpose voltage regimes according to those of Spaepen et al.

However, arguendo, even if there was some motivation for Pons et al to resort to the teachings of Spaepen et al and employ a pulsed power supply capable of imposing a plurality of superimposed voltages in the electrolysis of water of Pons et al, **although**

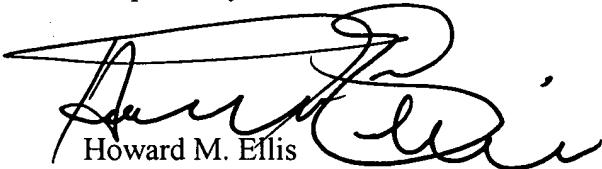
there is not, however, even if there was, **Appellants' claimed invention would still not be arrived at.** Spaepen et al, as outlined above, applies a first cell voltage regime with a greater amplitude (anodic pulse) followed by a lower cell voltage regime (cathodic pulse). This is **opposite Appellants claimed apparatus** which comprises means for generating a repeating sequence of voltages where according to claim 28, the second voltage regime is at least two times the voltage of the first cell voltage regime. By contrast, as pointed out above, Spaepen et al employ pulsed power supply that imposes a higher initial voltage followed by a second lower cell voltage regime. Accordingly, the voltage regimes of Spaepen et al are actually opposite to those of Appellants claims.

Accordingly, the combination of Pons et al in view of Spaepen et al is not viewed as meeting all the limitations of claims 28-30 and 33-41, on appeal.

Accordingly, Appellants courteously request reversal of the rejection of claims 28-30 and 33-41.

March 26, 2007

Respectfully submitted,



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CLAIMS APPENDIX

The claims on appeal are as follows:

Claim 28: An apparatus for electrolyzing water for the production of hydrogen, oxygen and heat, which comprises:

(i) an electrochemical cell having an isotopic hydrogen storage cathode, an electrically conductive anode and a compartment for holding an ionically conducting electrolyte comprising water, and

(ii) a pulsed power supply for said electrochemical cell comprising means for generating a repeating sequence of voltages across said anode and said cathode, each said sequence including a first cell voltage regime consisting of a voltage sufficient to enhance cathodic absorption of hydrogen and a second voltage regime consisting of at least one voltage pulse which is at least two times the voltage of the first cell voltage regime in magnitude with a duration no greater than 0.10 seconds.

Claim 29: The apparatus of Claim 28 wherein said voltage of said first cell voltage regime generated by said pulsed power supply ranges from about 1 to about 10 volts, and the voltage pulse of said second cell voltage regime ranges from 2 to 1000 times the voltage of said first cell voltage regime, and the total duration of said second voltage pulse ranges from about 0.5 nanoseconds to about 0.10 seconds.

Claim 30: The apparatus of Claim 28 wherein said pulsed power supply is operatively arranged to dovetail said second cell voltage regime onto said first cell voltage regime.

Claim 33: The apparatus of Claim 28, wherein said pulsed power supply is operatively arranged to superimpose said second cell voltage regime onto said first cell voltage regime.

Claim 34: The apparatus of Claim 29, wherein said pulsed power supply is operatively arranged to dovetail said second cell voltage regime onto said first cell voltage regime.

Claim 35: The apparatus of Claim 29, wherein said pulsed power supply is operatively arranged to superimpose said second cell voltage regime onto said first cell voltage regime.

Claim 36: The apparatus of Claim 28, wherein each said sequence of said pulsed power supply further includes a positive voltage sufficient for cleaning said anode.

Claim 37: The apparatus of Claim 28, wherein each said sequence of said pulsed power supply further includes a positive voltage sufficient for cleaning said cathode.

Claim 38: The apparatus of Claim 28, wherein said pulsed power supply is operatively arranged to re-equilibrate the cathode in a region of zero potential.

Claim 39: The apparatus of Claim 29, wherein said pulsed power supply is operatively arranged to re-equilibrate the cathode in a region of zero potential.

Claim 40: The apparatus of Claim 36, wherein said pulsed power supply is operatively arranged to apply a negative potential for further cathodic absorption of hydrogen.

Claim 41: The apparatus of Claim 37, wherein said pulsed power supply is operatively arranged to apply a negative potential for further cathodic absorption of hydrogen.

EVIDENCE APPENDIX

A copy of the Decision of the Board of Patent Appeals and Interferences dated January 31, 2003, is attached below as evidence for consideration in this Appeal.

The attached Board decision relates specifically to the parent application 08/334,952 (Now US Pat. 6,638,413), of the captioned application and is believed relevant to the one ground of rejection in the appeal of the instant application, to wit: The rejection of claims 28-30 and 33-41 under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al. Pages 13-15 of the attached Board decision considered the rejection of claims in the parent application, which are related to claims of the instant appeal. **The claims were also specifically rejected under 35 U.S.C. 103(a) over Pons et al in view of Spaepen et al. The Board in the decision reversed the rejection.**

The Board decision of January 31, 2003, was submitted as an attachment for the examiner's consideration in the instant application during *ex parte* prosecution with Appellants' Amendment and Request for Reconsideration filed November 2, 2006. The Examiner's Advisory Action of November 14, 2006, indicated for purposes of appeal the proposed amendment will be entered.

Hence, both the claims, as amended, and the decision of the Board of Patent Appeals and Interferences from the parent application were considered and entered by the examiner prior to this appeal.

The Decision of the Board is part of the record for purposes of this appeal, and qualifies for consideration in this appeal.

The opinion in support of the decision being entered today was not written for publication and is **not** binding precedent of the Board.

Paper No. 29



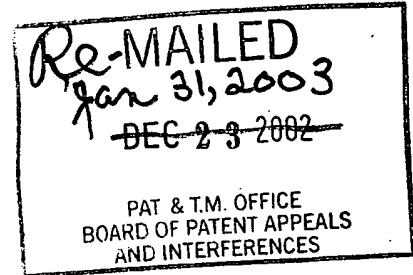
UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte NORMAN L. WEINBERG, KLAUS TOMANTSCHGER,
ROBERT S. FELDSTEIN,
J. DAVID GENDERS and JOSEPH M. RAIT

Appeal No. 1999-0928
Application No. 08/334,952

ON BRIEF



Before OWENS, WALTZ, and JEFFREY T. SMITH, **Administrative Patent Judges.**

WALTZ, **Administrative Patent Judge.**

DECISION ON APPEAL

This is a decision on an appeal from the primary examiner's final rejection of claims 1, 2, 4, 6 through 12, 14 through 27, 33, 34, 36 and 37.¹ The remaining claims pending in this application (claims 3, 5, 13 and 35) stand withdrawn from further consideration by the examiner as directed to a non-elected

¹ An amendment after final rejection was entered by the examiner and amended claim 27 but no claims were indicated as allowable (see the amendment dated Jan. 20, 1998, Paper No. 16, entered as per the Advisory Action dated Jan. 26, 1998, Paper No. 17).

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invention. See 37 CFR § 1.142(b). We have jurisdiction pursuant to 35 U.S.C. § 134.

According to appellants, the invention is directed to a method for the electrolysis of water for enhanced production of oxygen, hydrogen and heat by the application of a unique repeating sequence of voltages (Brief, pages 2 and 4).

Illustrative independent claim 1 is reproduced below:

1. A method for electrolyzing water to produce oxygen, hydrogen and heat which comprises the steps of:

(i) providing an electrochemical cell comprising an isotopic hydrogen storage cathode, an electrically conductive anode and an ionically conducting electrolyte comprising water, and

(ii) impressing a repeating sequence of voltages across said cathode and anode comprised of at least two cell voltage regimes, a first cell voltage regime consisting of a voltage sufficient to enhance cathodic absorption of hydrogen, and a second cell voltage regime consisting of at least one voltage pulse which is at least 2 times the voltage of the first cell voltage regime for a total duration no greater than 0.10 seconds.

A list of the prior art relied upon by the examiner as evidence of unpatentability may be found on pages 4-5 of the Answer. The following grounds of rejection are presented for our review in this appeal:

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(1) the claims on appeal stand rejected under 35 U.S.C. § 112, first paragraph, and under 35 U.S.C. § 101, for failing to provide an enabling disclosure due to the lack of utility and operativeness (Answer, pages 5 and 13);

(2) the claims on appeal stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite (Answer, page 11);

(3) claims 1, 2, 6-12, 14-18, 21-24, 27, 33, 34 and 37 stand rejected under 35 U.S.C. § 102(b) as anticipated by Horvath (*id.*);

(4) the claims on appeal stand rejected under 35 U.S.C. § 103 as unpatentable over Pons in combination with Spaepen and the admitted prior art (as evidenced by Mazur, Saito, Greenberg, or Suzuki, as disclosed on page 10 of the specification) (*id.*); and

(5) claims 1, 2, 6-12, 14-22, 33, 34, 36 and 37 stand rejected under 35 U.S.C. § 103 as unpatentable over Timewell in combination with either Sobieralski or Pons (Answer, page 12).

We reverse all of the examiner's rejections on appeal essentially for the reasons set forth in the Brief, Reply Brief and as stated below.

OPINION

A. *The Rejection under 35 U.S.C. § 112, ¶2*

A proper analysis of patentability should begin with the second paragraph of section 112, proceed to the first paragraph, and then analyze the prior art applied against the claimed subject matter under sections 102 and 103. *See In re Angstadt*, 537 F.2d 498, 501, 190 USPQ 214, 217 (CCPA 1976).

The examiner states that, in claim 1, line 2, it remains "unclear" whether the term "heat" constitutes "excess heat" (Answer, page 11). Therefore the examiner concludes that the "metes and bounds" of the claims are undefined (*id.*). However, the initial burden of establishing unpatentability, on any ground, rests with the examiner. *See In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). The legal standard for definiteness of claim language is whether a claim reasonably apprises those of skill in the art of its scope, when read in light of the specification. *See In re Warmerdam*, 33 F.3d 1354, 1361, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994); and *In re Angstadt*, *supra*.

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The examiner has failed to meet the initial burden in that no reasoning has been presented why the term "heat" would not reasonably apprise those of ordinary skill in this art of its scope (e.g., see Horvath, col. 11, ll. 4-26). The examiner has also failed to present any reasons why one of ordinary skill in this art, upon reading the specification, would be "unclear" whether "heat" includes "excess heat" (Answer, page 11). The term "heat," used in its normal and accepted art-recognized meaning, would include any production of heat energy, whether small or "excess" (Brief, page 22; specification, page 2, ll. 16-31, and pages 22-23).

For the foregoing reasons and those stated in the Brief and Reply Brief, we determine that the examiner has failed to establish that the claimed subject matter in question would not have reasonably apprised one of ordinary skill in this art of the scope of the claims. Accordingly, the rejection based on the second paragraph of 35 U.S.C. § 112 is reversed.

B. The Rejections under 35 U.S.C. § 101 and § 112, ¶1

The questions of whether a specification provides an enabling disclosure under § 112, ¶1, and whether an application

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satisfies the utility requirement of § 101 are closely related and thus we treat these two rejections together. See *In re Swartz*, 232 F.3d 862, 863, 56 USPQ2d 1703, 1703 (Fed. Cir. 2000). To satisfy the enablement requirement of § 112, ¶1, the patent application must adequately disclose the claimed subject matter so as to enable one of ordinary skill in the art to practice the invention at the time the application was filed without undue experimentation. See *Swartz, supra*. The utility requirement of § 101 mandates that the invention be operable to achieve useful results. See *Swartz*, 232 F.3d at 863, 56 USPQ2d at 1703-04. "Thus, if the claims in an application fail to meet the utility requirement because the invention is inoperative, they also fail to meet the enablement requirement because a person skilled in the art cannot practice the invention." *Swartz*, 232 F.3d at 863, 56 USPQ2d at 1704.

The examiner states that appellants' invention "falls into the 'cold fusion' category of alleged low temperature nuclear fusion/transformation reactions and 'excess heat' generation." Answer, page 5. The examiner further states that "[a]bsent

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evidence of the 'excess heat' generated at the indicated levels (570%) being from chemical reactions or merely lattice induced vibrations, then it follows that the excess heat is from alleged nuclear reactions of the 'cold fusion' system type." Answer, sentence bridging pages 5-6. The examiner finds that cold fusion systems involve decreasing the interatomic spacing between hydrogen isotopes in the host lattice to generate excess heat, such as disclosed by appellants, "regardless of any other name they may be given." Answer, page 6. The examiner considers appellants' invention as being based on the "cold fusion" concept set forth by Pons and Fleischmann and then discusses numerous references that refute this concept (Answer, pages 6-7). Accordingly, the examiner believes that a reasonable and sufficient basis has been set forth for challenging the adequacy of the disclosure, with a showing that claims of nuclear fusion and/or excess heat generation are not reproducible or even obtainable (Answer, page 10). We disagree.

The examiner has the initial burden of challenging an appellants' presumptively correct assertion of utility. See

Swartz, 232 F.3d at 864, 56 USPQ2d at 1704. "If the PTO provides evidence showing that one of ordinary skill in the art would reasonably doubt the asserted utility, however, the burden shifts to the applicant to submit evidence sufficient to convince such a person of the invention's asserted utility." Swartz, 232 F.3d 864, 56 USPQ2d at 1704, underlining added. Appellants do not, on this record, assert a utility involving "cold fusion" (Brief, page 10). The examiner makes the assertion that appellants' invention involves "cold fusion" (Answer, pages 5-11). The claims, as represented by claim 1 above, are directed to a method for electrolyzing water to produce oxygen, hydrogen and heat. The specification is only directed to this utility, i.e., the electrolysis of water to produce oxygen, hydrogen and heat (see the specification, page 1, ll. 8-11; and page 2, ll. 32-35). The examiner has not presented any evidence or reasoning to show that the asserted utility of electrolyzing water to produce oxygen, hydrogen and heat is inoperative or not obtainable. In fact, the examiner has applied prior art (Horvath) that shows the electrolysis of water with the production of oxygen, hydrogen and heat (see Horvath, col. 11, ll. 4-26; Reply Brief, page 3).

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Therefore appellants have provided a credible utility for the claimed subject matter and thus satisfy the utility requirement of § 101.

Similarly, the examiner has provided no basis or support for the assertion that the specification disclosure is non-enabling. Appellants have provided a schematic diagram and an example disclosing how to make and use the claimed invention (Brief, pages 17-21; specification, pages 15-25). The examiner's citation of numerous references that refute claims to "cold fusion" show that "cold fusion" would not occur without the production of tritium, neutrons, helium-4 and gamma rays (see, for example, Hilts, Chapline, Lewis, Alber, Faller, Hajdas, Ziegler, and Jones). The examiner has not cited any disclosure or allegation by appellants that such by-products of "cold fusion" have been produced. As discussed above, the examiner has not shown that appellants are claiming or alleging that their method involves "cold fusion."² See *Swartz*, 232 F.3d at 864, 56

² On page 14 of the Answer, the examiner asserts that "appellants have also admitted that the heat may be generated by 'cold fusion,'" referring to page 6 of the amendment dated Sep. 2, 1997 (Paper No. 14). However, these remarks by appellants are not an allegation that "cold fusion" occurs during their method but merely an assertion that the term "heat" includes any heat produced even if it might be generated by "cold fusion." See Paper No. 14, page 6.

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USPQ2d at 1704 ("In his written description and throughout prosecution of his application, Mr. Swartz continually represented his invention as relating to cold fusion.").

The only evidence the examiner presents is that appellants disclose that "excess heat" is sometimes generated by their method but appellants offer no explanation for this observation (Answer, page 14; Brief, page 11; specification, pages 23 and 25). However, the claims are limited to the production of "heat" (see claim 1 above) and the observation of "excess heat" in some examples is not sufficient and convincing evidence that "cold fusion" is involved in the claimed method. See Hiltz, where it is disclosed that the amount of heat produced depends on the amount of electrical power put into the process, and "excess" heat is only an excess over what the appellants assume they should get. Thus incorrect assumptions by appellants could result in the production of "excess heat." See also Kreysa, where the "excess heat" production of Pons and Fleischmann is attributed to the catalytic recombination of hydrogen and oxygen (page 441, last paragraph). Furthermore, see Ohashi, where

evidence of excess heat production without a relationship to concomitant production of neutrons, tritium, and helium, was explained by considering a recombination of hydrogen and oxygen evolved during the experiment, not by categorizing the experiment as "cold fusion" (page 729). Finally, Jones teaches that the production of excess heat generation during water electrolysis "could be readily terminated by the introduction of various barriers to the migration of hydrogen and oxygen" and that "[t]here is no compelling evidence that excess heat is of a nuclear origin in such electrolytic cells." Jones, page 6973, abstract. Therefore, on this record, the examiner has not presented any evidence that appellants' generation of "excess heat" during electrolysis of water is of a nuclear origin or that appellants' invention should be categorized as "cold fusion" but, on the contrary, the evidence of record supports the opposite view when "excess heat" is the only by-product of the electrolysis.

For the foregoing reasons and those stated in the Brief and Reply Brief, we determine that the examiner has not met the initial burden of presenting evidence to support that the claimed

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subject matter is inoperative or lacks enabling disclosure.

Accordingly, we cannot sustain the examiner's rejections under 35 U.S.C. § 101 and § 112, first paragraph.

C. The Rejection under 35 U.S.C. § 102(b)

The examiner finds that Horvath discloses a method comprising an electrolysis cell having an isotopic hydrogen storage cathode, an anode, and an electrolyte comprising water, with voltage sequences including a voltage pulse (Answer, page 11, citing col. 10, l. 60-col. 11, l. 26, and col. 13, l. 59 - col. 14, l. 5).

Under § 102(b), anticipation or lack of novelty requires that the prior art reference discloses, either expressly or under the principles of inherency, every limitation of the claim. See *In re King*, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986). From the examiner's findings noted above, there is no explanation as to why the "voltage pulse" of Horvath describes the claimed limitation of at least two cell voltage regimes, with the first voltage enhancing cathodic absorption of hydrogen while the second voltage is at least two times as large as the first voltage and has a duration no greater than 0.10 seconds (e.g.,

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see claim 1 on appeal). Accordingly, we cannot sustain the examiner's rejection under section 102(b) since the examiner has not found every limitation of the claims described by the reference.

D. The Rejections under 35 U.S.C. § 103

There are two rejections based on section 103 before us in this appeal. In the first rejection, the examiner combines Pons and Spaepen (along with the "admitted prior art") (Answer, page 11). The examiner finds that Pons discloses the same method as claimed but "lacks a specific showing of superimposing voltage regimes" (Answer, page 12). Therefore the examiner applies Spaepen for the disclosure of superimposing a high voltage pulse regime on to a low voltage regime to obviate ageing phenomena (id.). From these findings, the examiner concludes that it would have been obvious to include superimposing voltage regimes in the method of Pons, as taught by Spaepen, to have "enhanced curing ageing phenomena" (id.).

"When relying on numerous references or a modification of the prior art, it is incumbent upon the examiner to identify some suggestion to combine references or make the modification." In

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re Mayne, 104 F.3d 1339, 1342, 41 USPQ2d 1451, 1454 (Fed. Cir. 1997). It is well settled that before a conclusion of obviousness may be made based on a combination of references, there must have been a reason, suggestion, or motivation to lead the inventors to combine those references. See *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1629 (Fed. Cir. 1996). The examiner has found that Pons is directed to electrolyzing water to produce hydrogen, oxygen and heat using an isotopic hydrogen storage cathode, an anode, and an aqueous electrolyte (Answer, pages 11-12). However, the examiner has failed to note that Spaepen is directed to another type of electrolysis, namely that Spaepen teaches applying a potential pulse train for influencing an electrocatalytic reaction proceeding at the electrode, where this reaction is the oxidation of methanol on platinum or the oxidation of hydrogen, hydrazine, or ammonia on an alloy (Spaepen, col. 1, ll. 42-67). Spaepen teaches that it was already known to obviate partly some of the ageing phenomena which occur in electrocatalysts by bringing the electrode to another potential (col. 1, ll. 10-15). First, contrary to the examiner's proposed motivation (Answer, pages 12

and 15), Spaepen does not teach that the inventive pulsed regime obviates ageing phenomena, only that it was known in the art to obviate these phenomena by bringing the electrode to another potential (see col. 1, ll. 10-15). Secondly, the examiner has not identified any reason or suggestion why one of ordinary skill in the art of electrolyzing water would have included the pulsed regime of Spaepen in the method of Pons, whether used to obviate ageing phenomena or to influence the specified oxidation reactions at the electrode (see the Brief, page 25). The examiner has failed to identify why Pons would have desired obviation of ageing phenomena.

The "admitted prior art" (Answer, pages 11-12) has been applied by the examiner to show that it was well known in this art to have an electrolysis cell with an ion-exchange membrane divider. Therefore these references do not remedy the deficiency noted above.

For the foregoing reasons and those set forth in the Brief and Reply Brief, we determine that the examiner has failed to establish a *prima facie* case of obviousness in view of the reference evidence. Accordingly, we cannot sustain the

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examiner's rejection under 35 U.S.C. § 103 over Pons in combination with Spaepen and the "admitted prior art."

With regard to the second rejection based on section 103, the examiner finds that Timewell "substantially discloses the claimed invention," lacking only a specific showing of an isotopic hydrogen storage cathode (Answer, page 12). Therefore the examiner applies Sobieralski or Pons to show that isotopic hydrogen storage materials (e.g., palladium) are known in the art to be equivalent to aluminum for use as a cathode (Answer, paragraph bridging pages 12-13). Accordingly, the examiner concludes that it would have been obvious to have substituted an isotopic hydrogen storage material for the aluminum cathode of Timewell (Answer, page 13).

Assuming *arguendo* that Timewell discloses all limitations of the claimed subject matter except the use of an isotopic hydrogen storage cathode, we do not agree with the examiner that the secondary references disclose the equivalency of palladium and aluminum in the art of electrolyzing water and therefore there is no suggestion or motivation for the examiner's proposed

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modification or substitution. See *In re Mayne, supra*; and *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., supra*.

Timewell is directed to a method and apparatus for electrically conditioning electrode means positioned in an electrolyte (see col. 2, ll. 21-24). Timewell discloses use of a saltwater electrolyte with production of hydrogen at the cathode and relatively little oxygen at the depassivated anode (col. 3, ll. 28-31; col. 4, ll. 49-66). Pons, as previously discussed, is directed to the electrolysis of water to produce hydrogen, oxygen and heat but the examiner has failed to identify any portion of Pons that teaches the equivalency of aluminum and palladium as isotopic hydrogen storage cathodes (see the Answer, page 13, citing page 32 of Pons). Sobieralski is directed to the production of zinc powder from the electrolysis of lead-containing zinc halide solutions (abstract; col. 2, ll. 25-32). The cathode materials disclosed by Sobieralski are taught to be equivalents since they do "not detrimentally effect the operation of the process or the properties of the produced zinc to an intolerable extent." See col. 4, ll. 65-68. The examiner has not identified any reason, suggestion or motivation as to why one

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of ordinary skill in the art of electrolyzing water would have used the teaching of Sobieralski regarding the equivalency of cathode materials in the production of zinc and substituted these equivalents in the process of Timewell. Furthermore, the examiner has not presented any evidence or reasoning why one of ordinary skill in this art would have substituted an isotopic hydrogen storage cathode for the aluminum of Timewell, when there is no evidence on this record that aluminum is an isotopic hydrogen storage material (see the Brief, page 30).

For the foregoing reasons and those stated in the Brief and Reply Brief, we determine that the examiner has not established a *prima facie* case of obviousness in view of the reference evidence. Accordingly, we reverse the examiner's rejection under 35 U.S.C. § 103 over Timewell in combination with either Sobieralski or Pons.

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E. Summary

All of the rejections on appeal have been reversed.
Therefore the decision of the examiner to reject the claims on appeal is reversed.

REVERSED

Terry J. Owens
TERRY J. OWENS)
Administrative Patent Judge)

Thomas A. Waltz
THOMAS A. WALTZ)
Administrative Patent Judge)

Jeffrey T. Smith
JEFFREY T. SMITH)
Administrative Patent Judge)

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RELATED PROCEEDINGS APPENDIX

Upon information and belief, no appeals or interferences are known to Appellant, which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.